CLAIMS

1. A waveguide conversion device comprising a rectangular waveguide that has a rectangular cross-sectional shape, extends in a predetermined longitudinal direction, and transmits high frequency signals of the TE_{10} mode; and a circular waveguide that has a circular cross-sectional shape, is connected to an H plane of the rectangular waveguide at right angles, and transmits high frequency signals of the TM_{01} mode,

wherein an unnecessary-wave suppression groove is provided in a mode conversion part between the rectangular waveguide and the circular waveguide, the unnecessary-wave suppression groove preventing an unnecessary transmission mode from being excited in the circular waveguide when high frequency signals are transmitted between the waveguides.

2. The waveguide conversion device according to Claim 1, wherein the unnecessary-wave suppression groove is provided in either one or both of the rectangular waveguide and the circular waveguide and extends in a direction that is perpendicular to an electric field component of the TE_{11} mode in the circular waveguide that is the unnecessary transmission mode so as to have a length of one half or more than one half of the length of one wave of the high frequency signals.

3. The waveguide conversion device according to Claim 1 or 2, wherein the unnecessary-wave suppression groove is provided in the rectangular waveguide at a position corresponding to an axis of the circular waveguide.

4. The waveguide conversion device according to Claim 1 or 2, wherein the unnecessary-wave suppression groove is provided in the circular waveguide.

5. The waveguide conversion device according to any one of Claims 1 to 4, wherein an alignment part is provided between the rectangular waveguide and the circular waveguide, the alignment part being inserted into a part of the unnecessary-wave suppression groove when the waveguides are connected to each other to align the rectangular waveguide with the circular waveguide.

6. A waveguide rotary joint comprising two pieces of the waveguide conversion device according to any one of Claims 1 to 5, wherein circular waveguides of the individual waveguide conversion devices are disposed on the same axis and connected to each other so that the circular waveguides are rotatable.

7. An antenna device comprising two pieces of the waveguide conversion device according to any one of Claims 1 to 5, wherein circular waveguides of the individual waveguide conversion devices are disposed on the same axis and connected to each other so that the circular waveguides are rotatable, and either of the waveguide conversion devices includes a radiator for wireless communication.